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International Center for
Air Transportation

Impacts of Aircraft Flight Track Dispersion on Airport Noise

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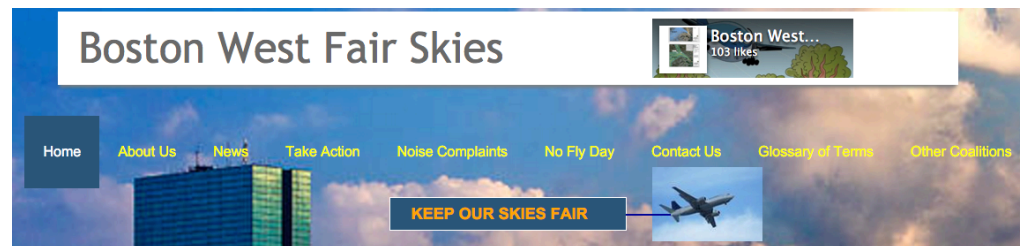
April 21, 2016

Problem Overview

- Performance Based Navigation (PBN) is a centerpiece of the FAA's NextGen program
 - NextGen projected cost: \$29 billion; projected benefit: \$133 billion¹
 - PBN responsible for substantial portion of benefits: shorter path length, increased throughput, reduced fuel burn
- Problem: PBN causes a concentration of flight tracks
 - ➔ Focusing of noise into narrower corridors

Important Issue for Communities

- Increasing noise complaint rates at major airports throughout US
 - E.g. tenfold increase in complaints for SFO since PBN implementation²
- Congressional pressure on FAA to address noise concentration issue
- Fundamental challenge for NextGen implementation



Day-Night Level

- DNL represents equivalent (average) noise level over a full day (86,400 seconds)
 - Based on single-event building blocks
 - 10 dB penalty for night operations
- Federal regulations mandate noise mitigation action for properties with >65 DNL
 - FAA has spent \$1.6 billion on noise mitigation³

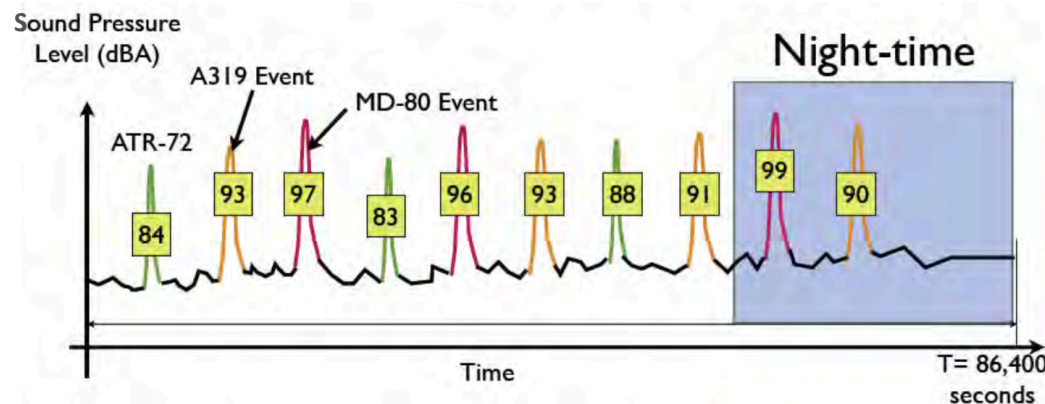
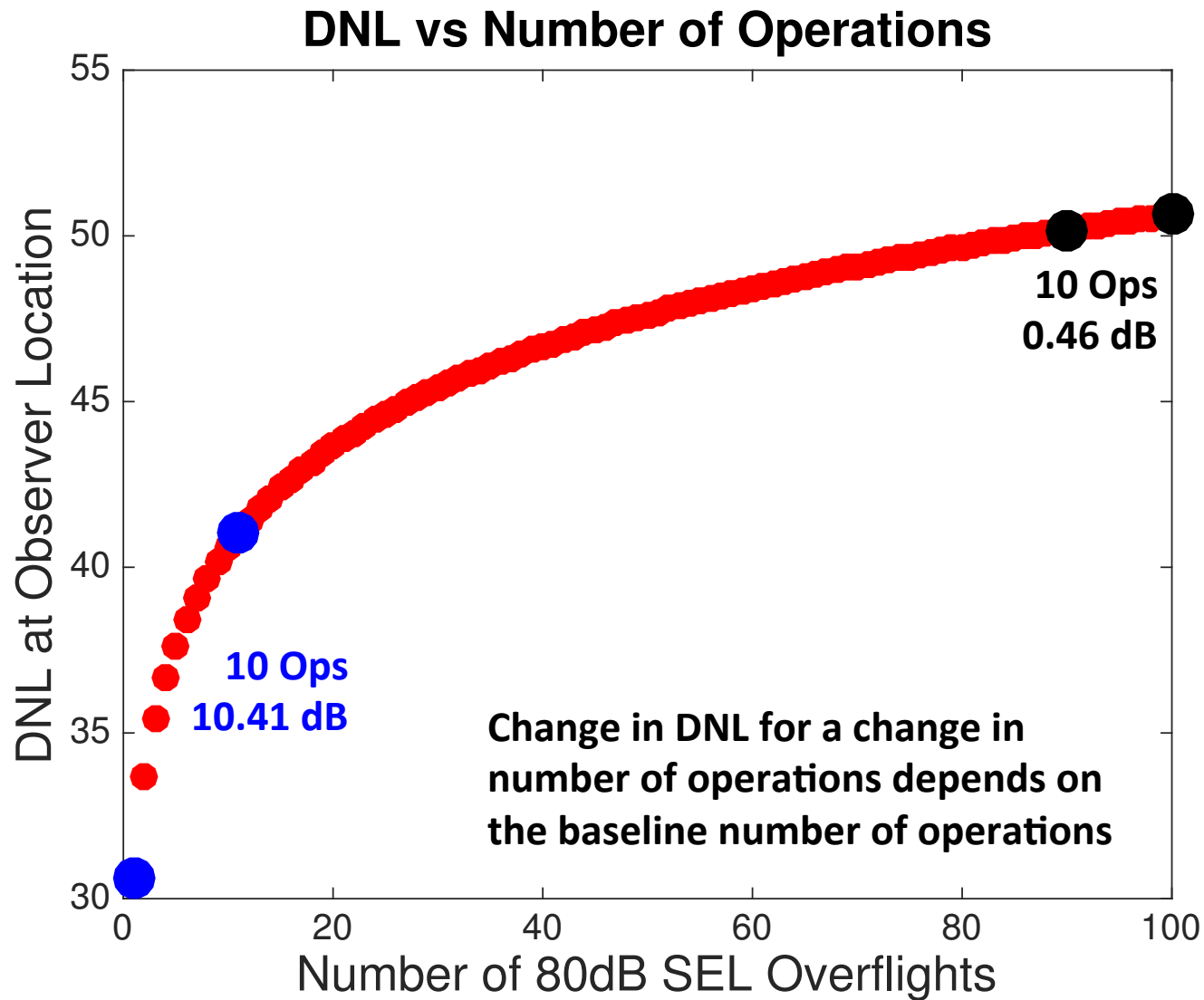
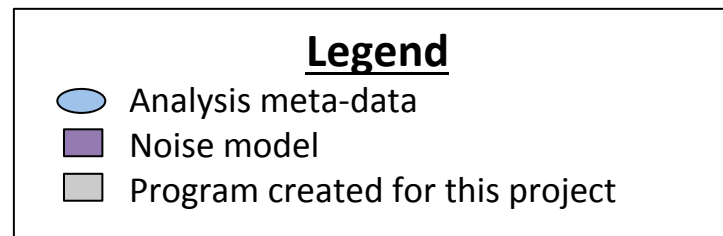
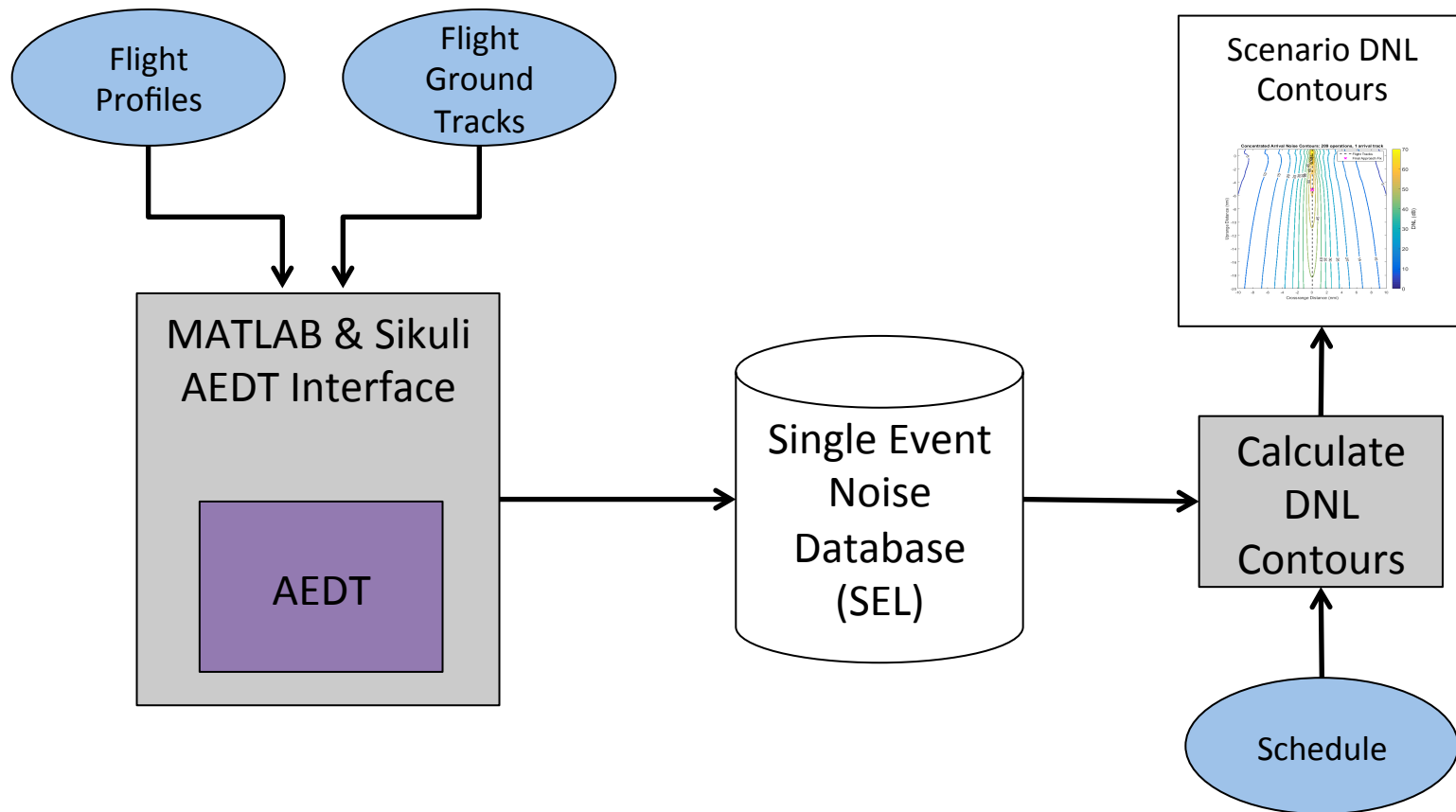


Figure: A. Trani, Virginia Tech

Implications of DNL



Noise Modeling Architecture

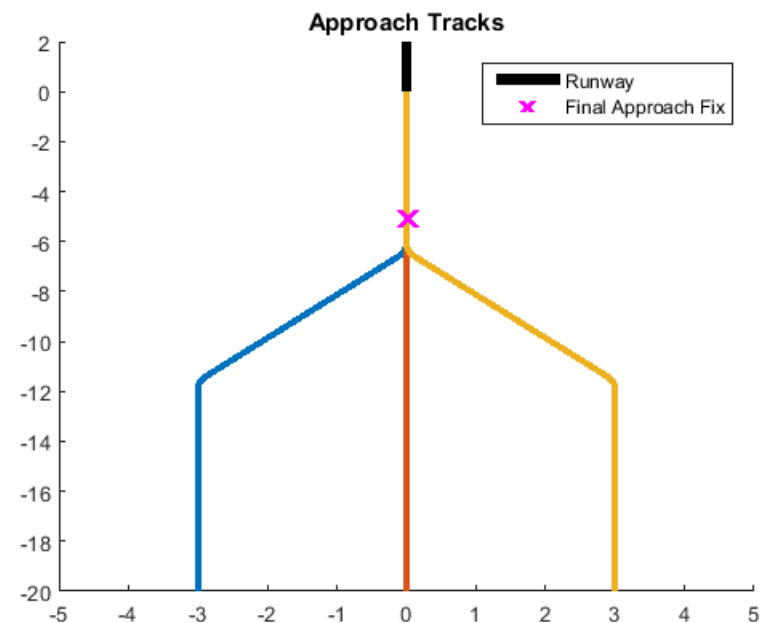


Overview of Studies

- Analyze effects of Equivalent Lateral Spacing Operations (ELSO) relative to a concentrated PBN track on both arrivals and departures
- How does dispersing flight tracks change noise? Is intentional dispersion using ELSO routes a worthwhile noise mitigation strategy?
- Considered two cases:
 - Arrival
 - Departure

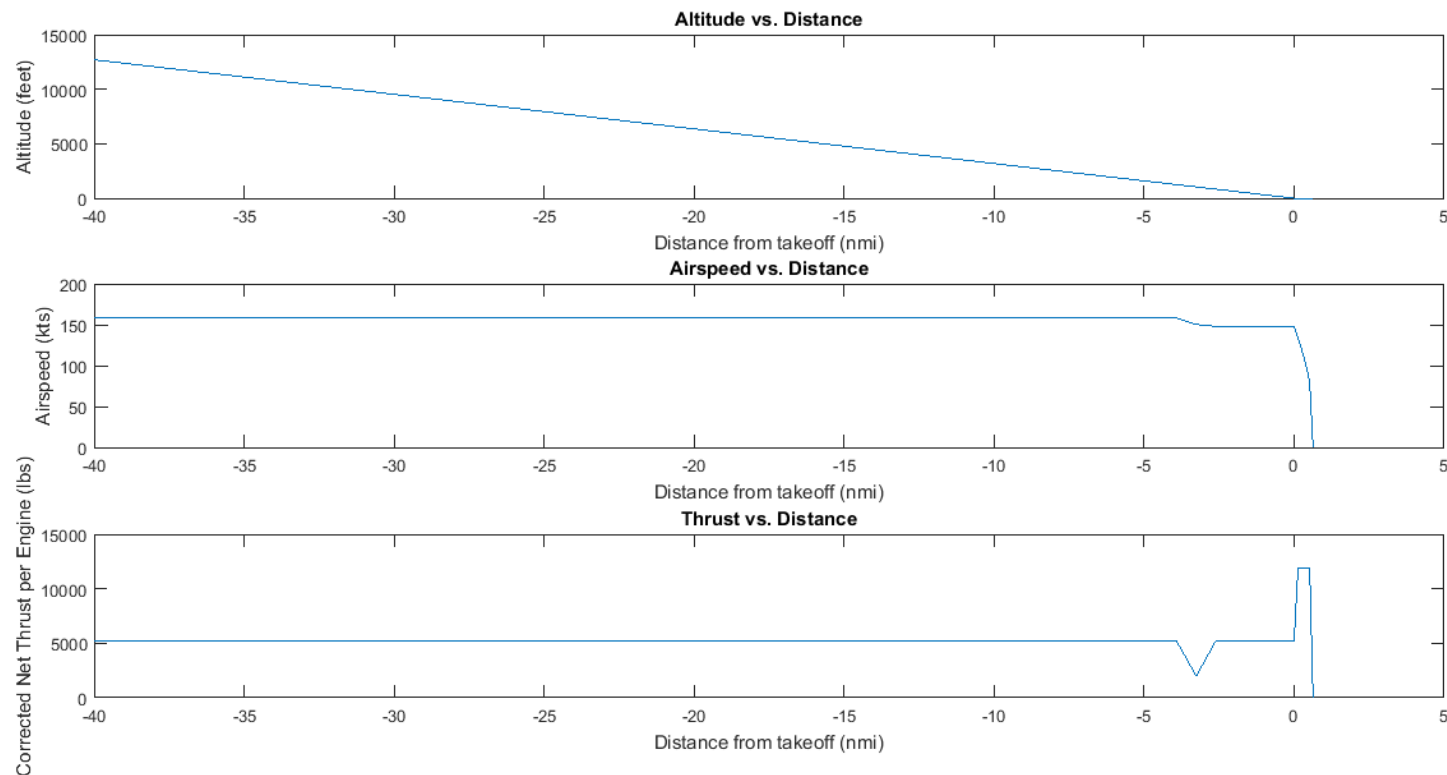
Arrival Case

- Single aircraft type (737-800) with day operations only
- 209 arrivals over the course of a day (average number of arrivals per day for March 2016 for Boston Logan runways 4R & 4L)
- 3 ELSO tracks approaching single runway with 3 nmi spacing, intercept 1 nmi before final approach fix
- 2 cases:
 - **Concentrated:** All on straight-in track
 - **Dispersed:** spread evenly between the 3 ELSO tracks



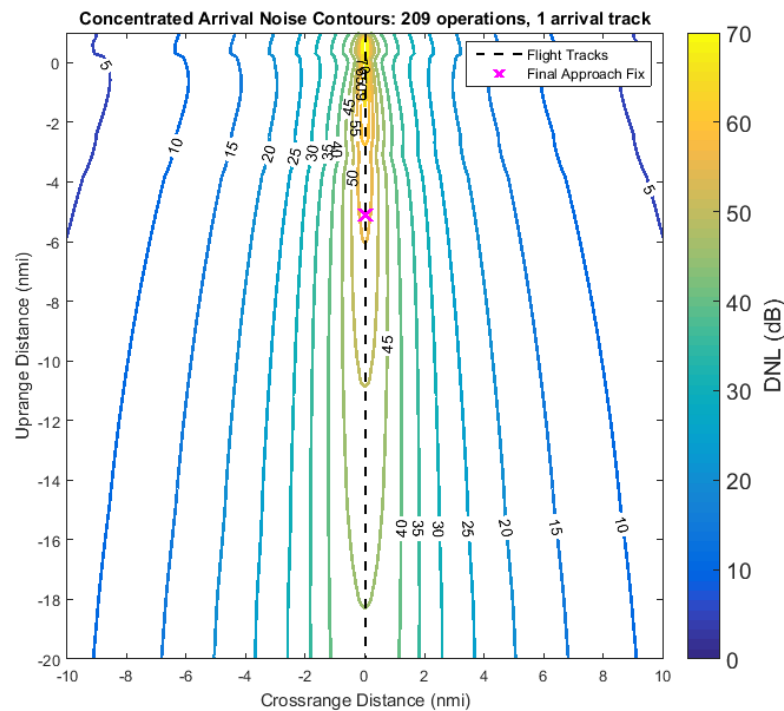
Arrival Profile

- Simple 3-degree glide slope constant descent approach

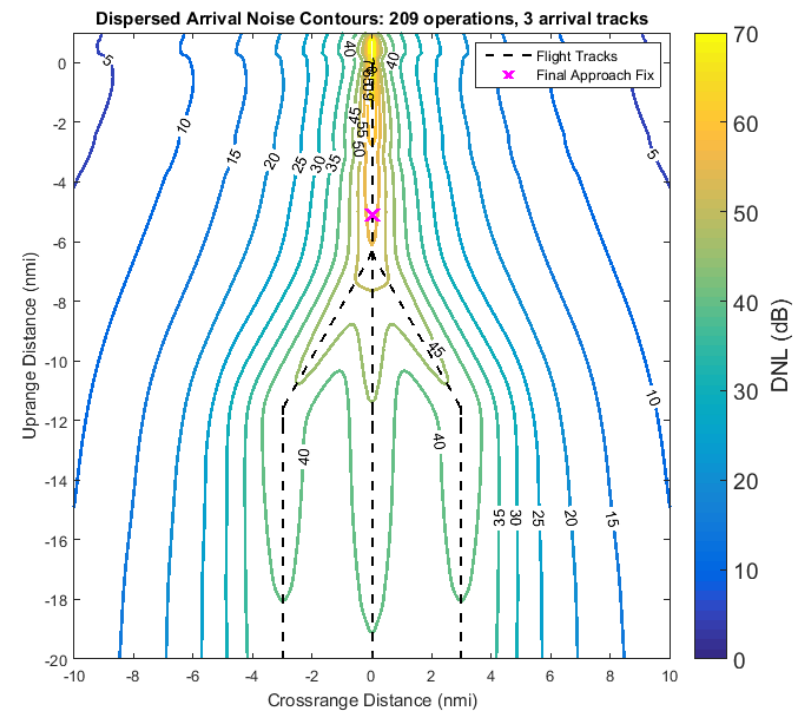


Arrival Noise Contours

209 arrivals concentrated
on 1 track:

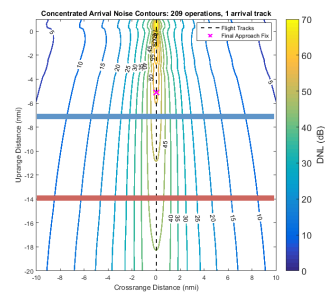
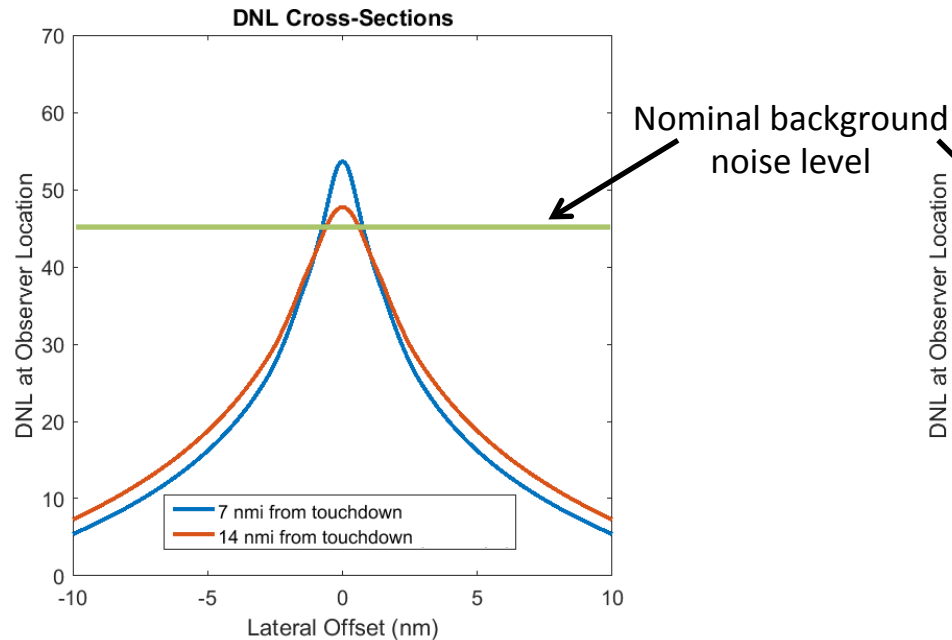


209 arrivals dispersed
on 3 ELSO tracks:

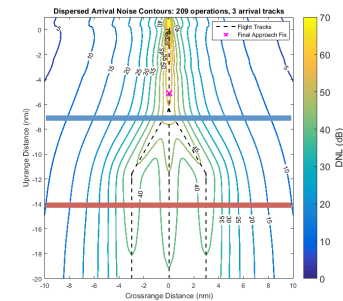
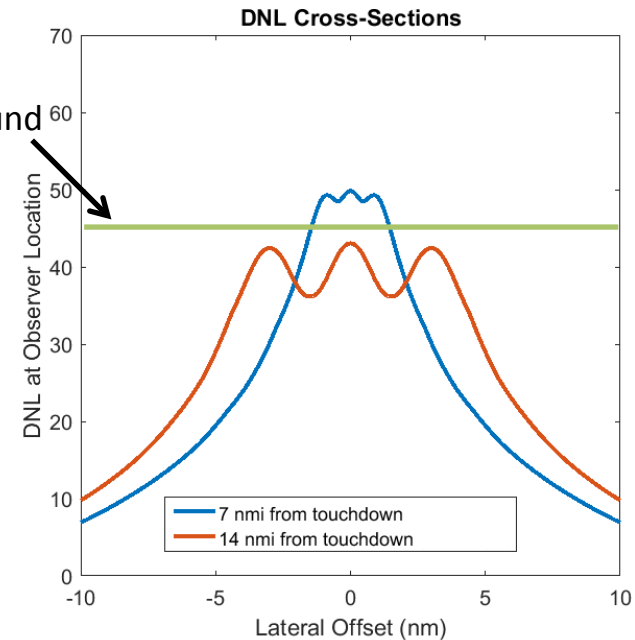


Arrival Noise Cross Sections

209 arrivals concentrated
on 1 track:

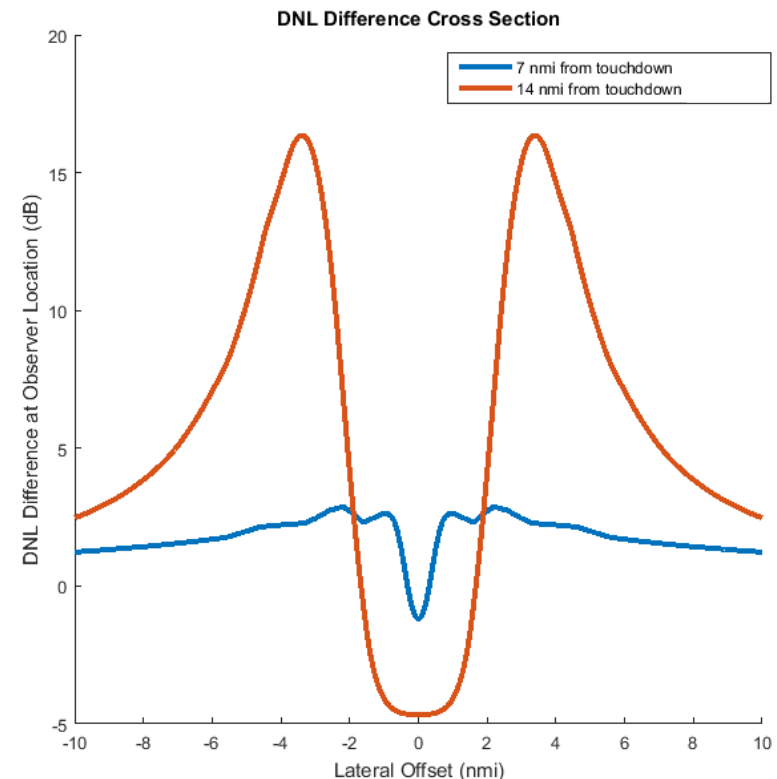
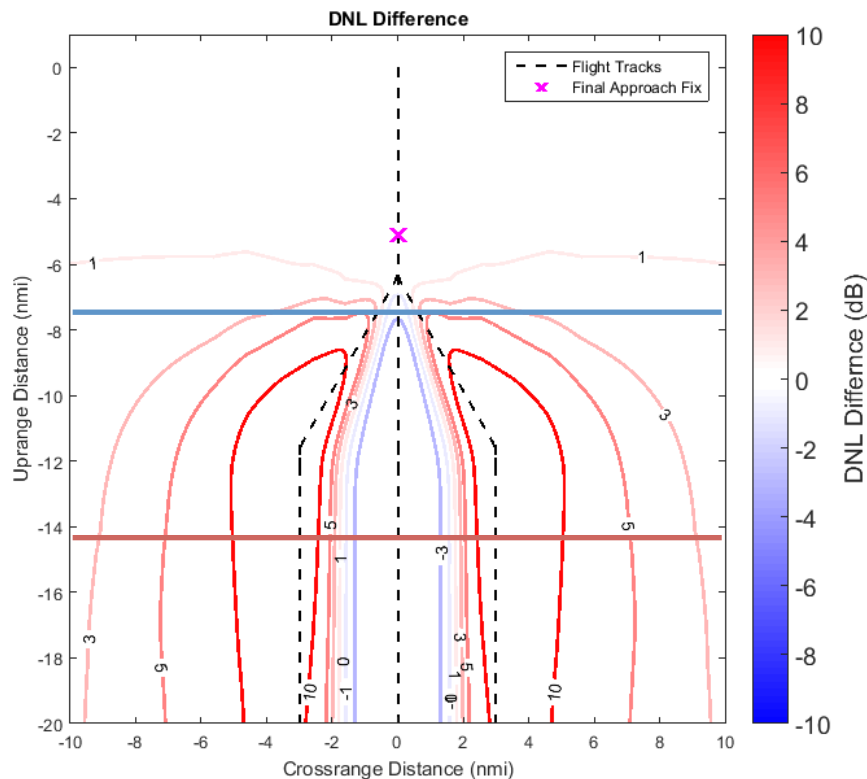


209 arrivals dispersed
on 3 ELSO tracks:



Arrival Noise Differences

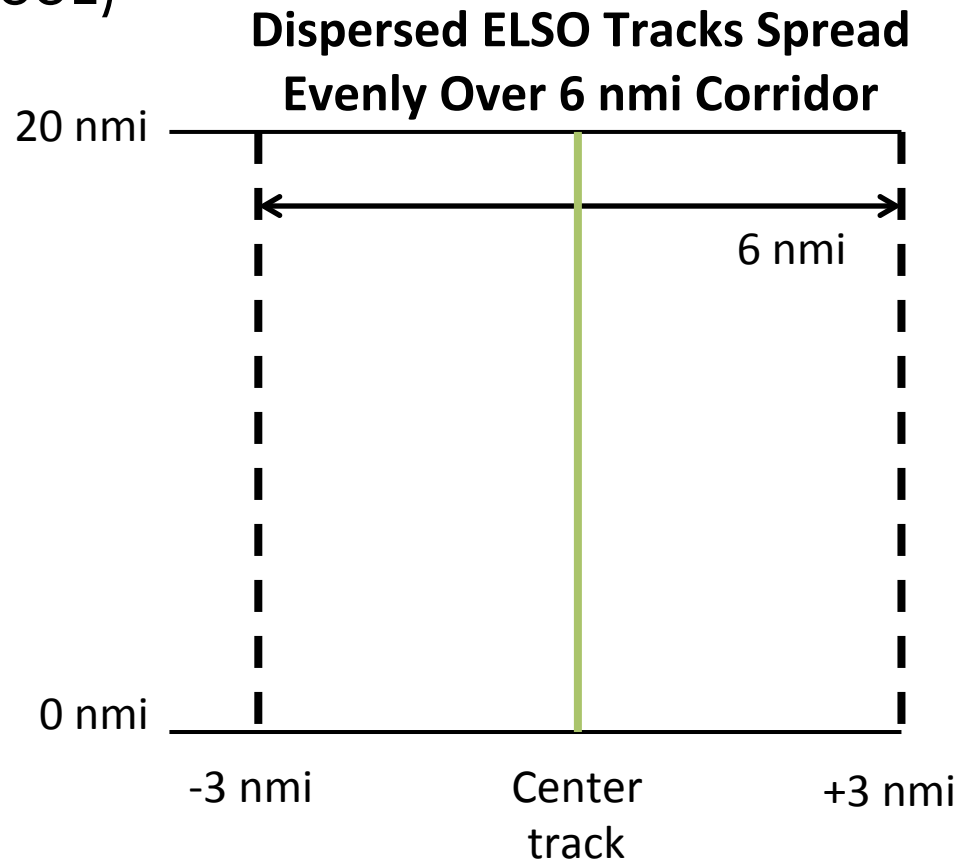
- DNL difference between concentrated and dispersed scenarios



- Takeaways:
 - At 7 nmi: 1 dB reduction in center, 3 dB increase at edges
 - At 15 nmi: 4 dB reduction in center, 16 dB increase at edges

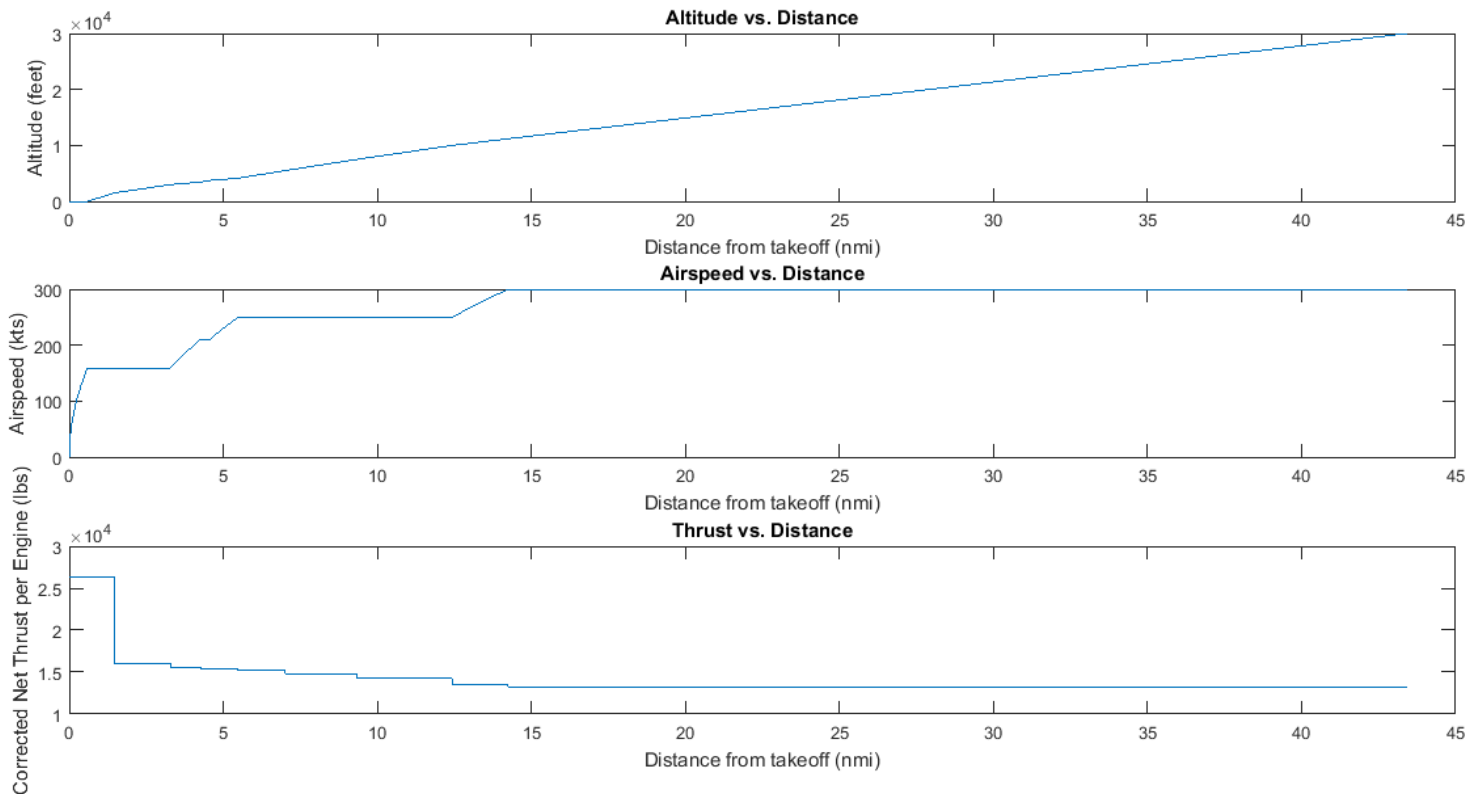
Departure Case

- Single aircraft type (737-800) with day operations only
- 102 departures over the course of a day (average number of departures per day for March 2016 for Boston Logan runway 33L)
- 2 cases:
 - **Concentrated:**
All on a single center track, or
 - **Dispersed:**
Parallel ELSO tracks spread evenly over 6 nmi corridor (width chosen for comparison to arrival dispersion)



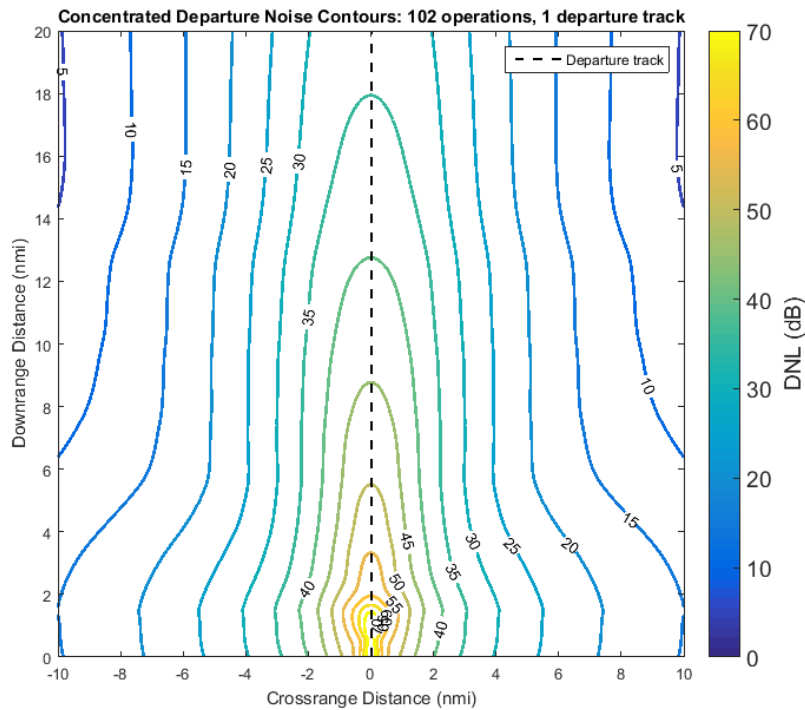
Departure Profile

- Climb from sea level to 30,000 ft, based on standard ICAO 3 departure as defined in AEDT

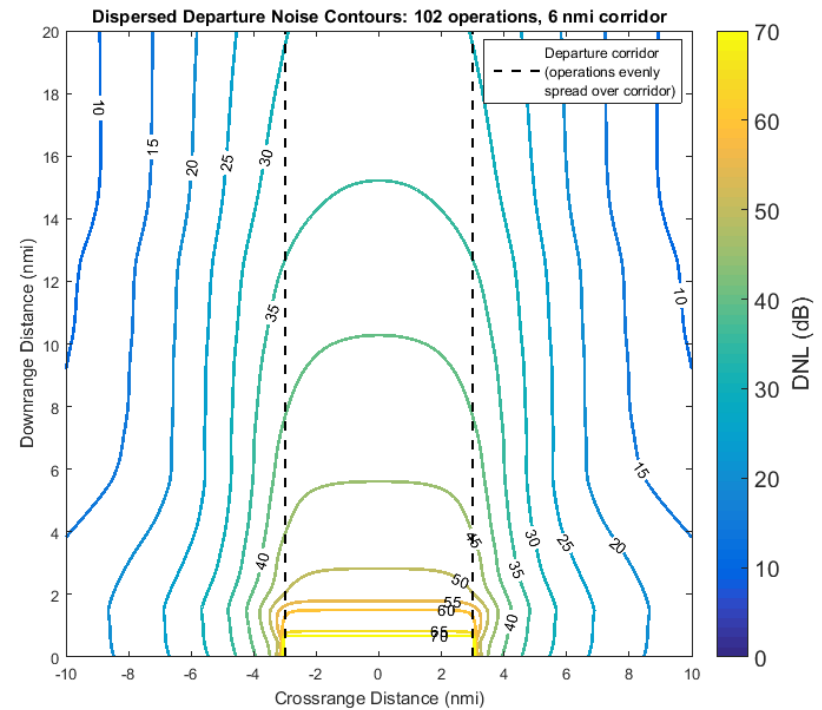


Departure Noise Contours

102 departures concentrated
on 1 track:

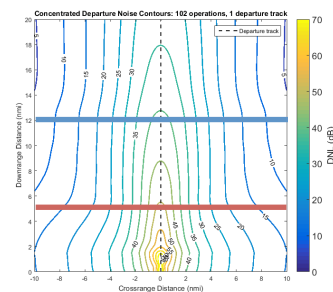
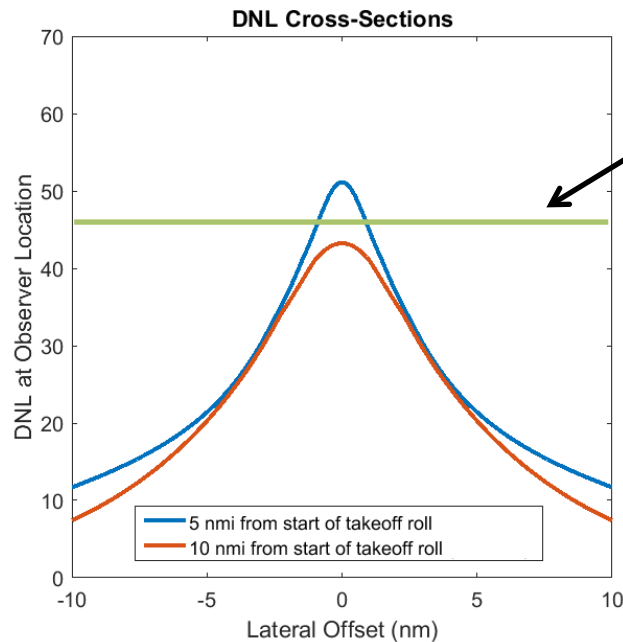


102 departures dispersed
evenly over 6 nmi corridor:

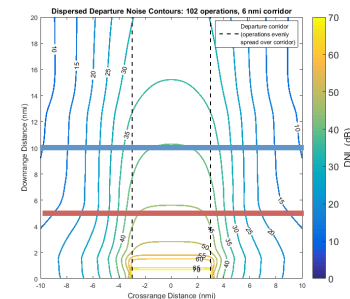
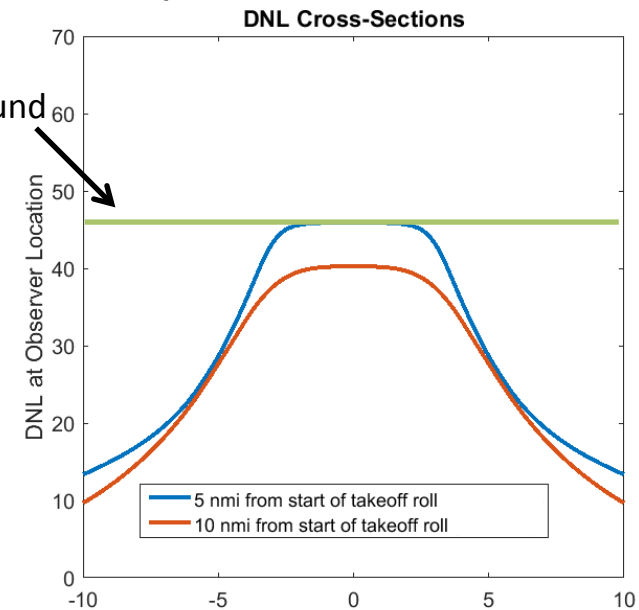


Departure Noise Cross Sections

102 departures concentrated
on 1 track:

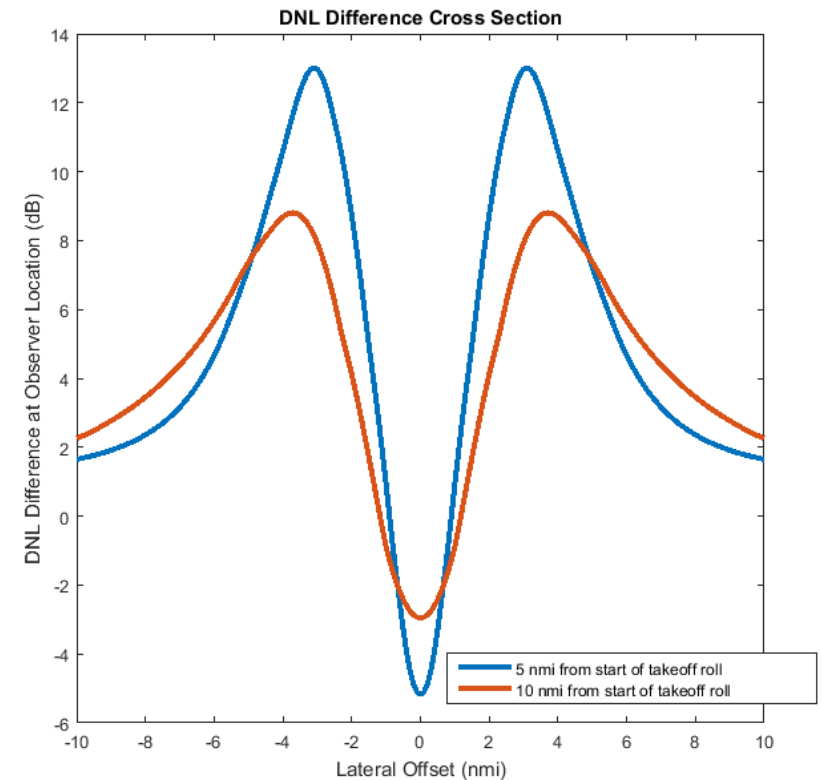
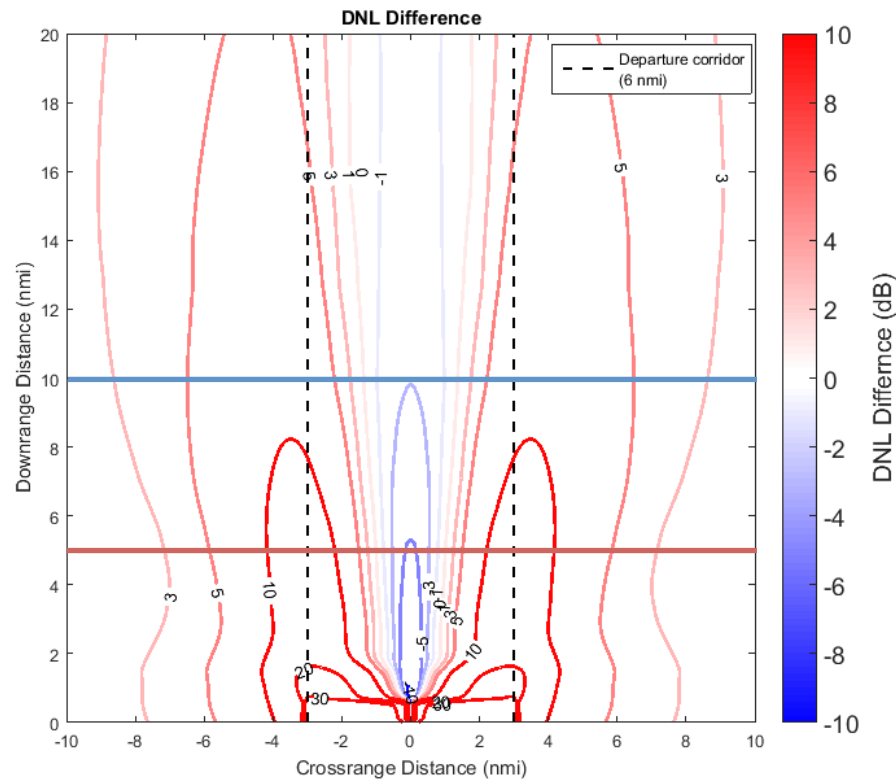


102 departures dispersed
evenly over 6 nmi corridor:



Departure Noise Differences

- DNL difference between concentrated and dispersed



- Takeaways:
 - At 5 nmi: 5 dB reduction in center, 13 dB increase at edges
 - At 10 nmi: 3 dB reduction in center, 9 dB increase at edges

Conclusions

- Dispersion does allow reduction under centerline, but results in substantial increases off-center
 - Can be useful to reduce DNL at all locations below a certain threshold (e.g. DNL 65)
- Conversely, replacing legacy procedures with PBN (tracks going from dispersed to concentrated) will cause an increase in noise along the center line, but will reduce noise substantially off-axis
 - Noise complaints show increases in noise, but no metric for noise benefits

Next steps

- Leverage methodology to calculate noise for full airport scenarios
- Tool analysis: AEDT vs. ANOPP
- Examine noise impacts of PBN track which is not centered over the same track as original dispersed tracks (expect much more drastic noise increases at locations directly under new track)